Claims

What is claimed is:

1. A method for identifying biological material containing volatile and/or non-volatile biomarker precursors, the method comprising:

contacting the biological material with a catalyst;

heating to a catalytic temperature to form volatile biomarkers;

detecting and identifying the biomarkers.

2. A method as in Claim 1 wherein the biological material contains bacterial spores.

3. A method as in Claim 1 wherein the biological material contains one or more of spores, bacteria, virus, and toxin.

4. A method as in Claim 1 wherein the biological material contains one or more spores selected from *Bacillus anthracis, Bacillus thuringiensis,* and *Bacillus subtilis* var *Niger.*

5. A method as in Claim 1 wherein the biomarker precursors include one or more of, fatty acids, proteins, carbohydrates, deoxyribonucleic acid (DNA), lipids, and dipicolinic acid.

6. A method as in Claim 1 wherein the contacting is in a liquid phase or a gas phase.

7. A method as in Claim 1 wherein the volatile biomarkers include one or more of picolinic acid, and fatty acid methyl esters, and the catalyst is an acid/base catalyst.

8. A method as in Claim 1 wherein the catalyst is a derivatization catalyst to esterify the biomarker precursors.

9. A method as in Claim 1 wherein the catalyst is a superacid catalyst and the volatile biomarkers are formed by derivation of fatty acids.

10. A method as in Claim 1 wherein the catalyst is a superacid catalyst and the volatile biomarkers are formed by methylating fatty acids.

11. A method as in Claim 1 wherein the catalytic temperature is less than temperatures required for pyrolysis of the biological material.

12. A method as in Claim 1 wherein the catalytic temperature is less than 300 degrees centigrade.

13. A method for identifying biological material containing non-volatile and volatile biomarker precursors, the method comprising:

contacting in liquid phase the biological material with a super acid catalyst;

heating to a catalytic temperature to methylate the non-volatile biomarker precursors to form methylated-ester biomarkers;

detecting and identifying the methylated-ester biomarkers.

14. A method as in Claim 13 wherein the non-volatile biomarker precursors comprise fatty acids and the methylated volatile biomarkers comprise fatty acid methyl esters.

15. A method as in Claim 13 wherein the non-volatile biomarker precursors comprise dipicolinic acid and the methylated volatile biomarkers comprise a methyl ester of dipicolinic acid.

16. A method as in Claim 13 wherein the catalyst is tungstophosphoric acid ($H_3WP_{12}O_{40}$).

17. A method as in Claim 13 wherein the biological material contains one or more spores selected from *Bacillus anthracis, Bacillus thuringiensis,* and *Bacillus subtilis* var *Niger.*

18. A method as in Claim 1 wherein the catalyst is a decomposition catalyst to break down biomarker precursors.

19. A method as in Claim 1 wherein the catalyst is a metal decomposition catalyst and volatile biomarkers are formed by breaking carbon-carbon bonds.

20. A method for identifying biological material containing non-volatile biomarker precursors, the method comprising:

contacting in gas phase the biological material with a solid metal decomposition catalyst;

heating to a catalytic temperature to degrade non-volatile biomarker precursors to form volatile degradation products;

detecting and identifying the volatile degradation products.

21. A method as in Claim 20 wherein the non-volatile biomarker precurors comprises one or more of fatty acids, protein, peptidoglycan, and DNA.

22. A method as in Claim 20 wherein the catalyst comprises one or more noble or base metals.

23. A method as in Claim 20 wherein the catalyst comprises one or more of Pt, Ni, Pd, and Rh.

24. A method as in Claim 1 wherein the detecting and identifying the biomarkers comprises analytical chemistry techniques selected from gas chromatography, mass spectrometry, and ion trap mass spectrometry.

25. A method as in Claim 1 wherein contacting with the catalyst comprises contacting with decomposition catalyst to break down the biomarker precursors and contacting with a derivatization catalyst to esterify the biomarker precursors.

26. A method as in Claim 1 wherein the heating comprises contacting with a heated metal mesh.

27. A method as in Claim 1 wherein the heating and the contacting with a catalyst are both accomplished by contacting with a heated metal mesh having a catalytically active surface.

28. An apparatus for identifying biological material containing non-volatile and volatile biomarker precursors, the apparatus comprising:

a reaction zone with a catalyst constructed and configured for contacting the biological material with the catalyst and heating the biological material to a catalytic temperature to form volatile biomarkers;

collection for collecting the biomarkers for detection and identification.

29. An apparatus as in Claim 28 wherein the reaction zone comprises first and second contacting and heating zones, the first zone comprising a decomposition catalyst to break down the biomarker precursors; the second zone comprising a derivatization catalyst to esterify the biomarker precursors.

30. An apparatus as in Claim 28 wherein the collection zone comprises one or more of gas chromatography systems and mass spectrometry systems.

31. An apparatus as in Claim 28 wherein the reaction zone comprises a metal mesh that functions as the heater.

32. An apparatus as in Claim 31 wherein the metal mesh has a catalytically active surface and functions as the catalyst.

33. An apparatus as in Claim 31 wherein the mesh is single-layered or multilayered or foam-like.

34. An apparatus as in Claim 31 wherein the mesh in constructed to distribute liquid samples across the heated surface.